New claims 15-20 are introduced. In light of the remarks herein regarding claims 1-4 and 7-8, it is believed that these claims define subject matter that is patentable over the known art.

In light of the above amendments and remarks, it is respectfully submitted that all of the Examiner's rejections and objections have been overcome. Reconsideration and allowance of the outstanding claims are respectfully solicited.

Respectfully,
Arthur Robert Calderbank
Ayman Naguib
Nambirajan Seshadri

Dated: ______________

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Appendix A – Marked-up version showing changes

IN THE SPECIFICATION:

Page 1, replace the title paragraph beginning at line1 with:--

Combined Channel Coding and Space-Time Block Coding in a Multi-Antenna Arrangement --;

Page 1, replace the paragraph beginning at line14 with:--

- U.S. Application 09/[......]114,838, filed [.....]July 14, 1998, titled "Combined Array Processing and Space-Time Coding," which is based on U.S. Provisional Application No. 60/052,689, filed July 17, 1997.--;

Page 4, replace the paragraph beginning at line 9 with:

In the aforementioned 09/[....]114,838 application, an arrangement is disclosed that provides enhanced performance which is realized by employing a perspective that combines array signal processing with channel coding. Specifically, antennas at the transmitter are partitioned into small groups, and individual space-time codes are used to transmit information from each group of antennas. At the receiver, an individual space-time code is decoded by a linear array processing technique that suppresses signals transmitted by other groups of antennas by treating them as interference. The contribution of the decoded signal to other received signal is then subtracted from those received signals. What results is a simple receiver structure that provides diversity and coding gain over uncoded systems with a given diversity gain. This combination of array processing at the receiver and coding techniques for multiple transmit antennas provides reliable and very high data rate communication over wireless channels. One advantage of the group interference suppression method over the Foschini architecture is that the number of receive antennas can be less than the number of transmit antennas.--;

Page 5, replace the paragraph beginning at line 7 with:

Enhanced performance is achieved by combining channel coding with the space-time coding principles disclosed in the '163 applications. More specifically, with K *synchronized* terminal units transmitting on N antennas to a base station having $M \geq K$ receive antennas, increased system capacity and improved performance are attained by using a concatenated coding scheme where the inner code is a space-time block code and the outer code is a conventional channel error correcting code. That is, information

symbols are first encoded using a conventional channel code. The channel code [is then] encoded signal is then encoded using a space-time block code, and transmitted over N antennas. At the receiver, the inner space-time block code is used to suppress interference from the other co-channel terminals and soft decisions are made about the transmitted symbols. The channel decoding that follows makes the hard decisions about the transmitted symbols.--;

Page 5, replace the paragraph beginning at line 19 with:--

Increased data rate is achieved by, effectively, splitting the incoming data rate into multiple channels, and each channel is transmitted over its own terminal. Viewed another way, information symbols from a transmitting terminal is split into L parallel streams. Stream l is encoded using a channel code with rate R_l and then coded with a space-time block encoder with N transmitting antennas. Advantageously, the coding rates are chosen such that [$R_1 > R_2 > \mathrm{L} > R_L$] $\underline{R_1 < R_2, < \mathrm{L}\ , < R_L}$.--;

Page 14, replace the paragraph beginning at line 8 with:--

FIG. 2 presents an arrangement for increasing the data rate or throughput in wireless systems. In FIG. 2, the information to be transmitted is demultiplexed in element 40 into two streams. One stream is applied to channel encoder 41, and the other stream is applied to channel encoder 51. The output of channel encoder 41 is applied to space-time block encoder 42, and then to mapper and pulse shaper 43 and antennas 44 and 45. Similarly, the output of channel encoder 51 is applied to space-time block encoder 52, and then to mapper and pulse shaper 53 and antennas 54 and 45. Generalizing, information symbols from a transmitting terminal are split into L parallel streams. Stream l is then encoded using a channel code with rate R_l and then coded with a space-time block encoder with N transmitting antennas. The coding rates can be the same, but an advantage accrues when the coding rates are chosen such that [$R_1 > R_2 > \mathrm{L} > R_L$] $\underline{R_1 < R_2, < \mathrm{L}\ , < R_L}$. In such a case, symbols transmitted in stream l will have better immunity against channel errors as compared to symbols transmitted in stream u where $u>l$. The base station receiver is assumed to be equipped with at least L receive antennas. The base station receiver treats each stream as a different user and uses the iterative interference cancellation techniques disclosed above, or the ones disclosed in the aforementioned '163 application. Since the first stream has the smallest coding rate

R_l, it has the best immunity against the channel errors and most likely it will be error free. The receiver then uses the decoded symbol of stream l to subtract the contributions of the first stream in the total received signals, while decoding the remaining L-l streams. In decoding the remaining L-l streams, the decoder decodes signals from the second stream first, since it has the best immunity against channel errors among the remaining L-l streams (due to its lowest rate, R_2 from among the remaining streams). Then the receiver uses the decoded symbols for the second stream to cancel out its contribution in the received signal. This process is repeated until all streams are decoded.--.

IN THE CLAIMS:

8. (Amended) The transmitter of claim [1] 3 where said channel code encoder performs convolutional encoding.